

**CLAIMS:**

1. A functional transition metal silicate (FTMS) effective as a decontaminant, a disinfectant, a detoxificant, a protectant, a microbicide or combination thereof,  
5 comprising a ratio of transition metal to silica in the transition metal silicate in a predetermined range and a structural composition for said effectiveness, said FTMS being capable of being immobilized on a suitable materials or incorporating into resins and / or coating along with resins on suitable materials.
2. A transition metal silicate of claim 1 wherein a transition metal, wherein said ratio  
10 of transition metal to silica in the transition metal silicate is in a range of about 0.34 to about 19.57.
3. A transition metal silicate of claim 1, wherein a transition metal, comprising  
variable functions even with similar transition metal silicate ratio based on structural composition having specific ESR(g) values and specific XRD pattern  
15 obtained by varied reaction conditions.
4. A transitional metal silicate of claim 1, wherein the varied reaction conditions as  
claimed are varied pH conditions during a process for preparing the transitional metal silicates including extreme acidic to 12 pH, reactant concentrations: silicate content in  
soluble alkaline silicate solution and ratio of transition metal salt solution to soluble  
20 alkaline silicate solution, varied temperature maintained between 20 to 95 degrees centigrade, and combinations thereof.
5. A transition metal silicate of claim 1, wherein the transition metal silicate is  
selected from the group consisting of cupric silicate, silver silicate, manganese silicate, zinc silicate, zirconium silicate and combination thereof.
- 25 6. A transition metal silicate of claim 1, wherein the transition metal silicate is effective as a decontaminant of metals, chemicals, pesticides, microbes or combination thereof.
7. A transition metal silicate of claim 1, wherein the transition metal silicate is  
effective as a disinfectant of a bacteria, a fungus, a virus, a microbicide of a  
30 pathogen or combinations thereof.
8. A transition metal silicate of claim 1, wherein the transition metal silicate is  
effective as a detoxificant of carbon monoxide, sulphur dioxide, an oxide of nitrogen, a hydrocarbon, tobacco tar, nicotine or toxic gases or chemical conversion  
of toxic gases and / or toxic chemical containing gases into non-toxic form, or  
35 combinations thereof.

9. A transition metal silicate of claim 6, wherein the metals are arsenic, mercury, lead, toxic metals or combinations thereof.
10. A transition metal silicate of claim 7, wherein the bacteria is a coliform bacteria, a Gram positive, a Gram negative bacteria or combinations thereof.
- 5 11. A transition metal silicate of claim 7, wherein the fungus is pathogenic fungi such as *Sclerotium rolfsii*, *Rhizoctonia solani*, *Fusarium oxysporium*, *Pyricularia oryzae* or combinations thereof.
12. A transition metal silicate of claim 7, wherein the virus is having infective in nature.
- 10 13. A transition metal silicate of claim 1, wherein the transition metal silicate is prepared by a method comprising:
  - (a) adding a solution of the transition metal to a soluble alkali silicate solution to form a mixture;
  - (b) adjusting pH and / or temperature of the mixture;
  - 15 (c) forming a precipitate comprising the transition metal silicate;
  - (d) washing and drying the precipitate to obtain the transitional metal silicate.
14. A composition comprising a transition metal silicate immobilized on a substance, the transition metal silicate comprising a transition metal, wherein a ratio of transition metal to silica in the transition metal silicate is in a range of about 0.34 to  
20 about 19.57 and / or with a functional structure and the transition metal silicate is effective as a decontaminant, a disinfectant, a detoxificant or microbicide or combination thereof.
15. The composition of claim 14 wherein the substance is selected from a group consisting of an agropolymer, activated alumina, aluminium oxide, cellulose, vinyl  
25 ester resin, a bisphenol resin, an isophthalic food grade resin, quartz sand, silica gel and combinations thereof.
16. A composition comprising a transition metal silicate incorporated in a substance, the transition metal silicate comprising a transition metal, wherein a ratio of transition metal to silica in the transition metal silicate is in a range of about 0.34 to  
30 about 19.57 and / or with functional structure and the transition metal silicate is effective as a decontaminant, a disinfectant, a detoxificant or microbicide or combination thereof.
17. The composition of claim 16, wherein the substance is a resin.

18. The composition of claim 16, wherein the resin is selected from a group consisting of a vinyl ester resin, a bisphenol resin, a isophthalic food grade resin and combinations thereof.
- 5 19. A composition for a coating comprising a transition metal silicate comprising a transition metal, wherein a ratio of transition metal to silica in the transition metal silicate is in a range of about 0.34 to about 19.57 and / or with a functional structure and the transition metal silicate is effective as a decontaminant, a disinfectant, a detoxificant, a microbicide or combination thereof.
- 10 20. The composition of claim 19, wherein the coating further comprises a resin and a solid material.
21. The composition of claims 14, 16 or 19, wherein the transition metal silicate is selected from the group consisting of cupric silicate, silver silicate, manganese silicate, zinc silicate, zirconium silicate and combination thereof.
- 15 22. The composition of claims 14, 16 or 19, wherein the transition metal silicate is effective as a decontaminant of a metal, a chemical, a pesticide or microbe or combination thereof.
23. The composition of claims 14, 16 or 19, wherein the transition metal silicate is effective as a disinfectant of a bacteria, a fungus, a virus, a microbe of a pathogen or combinations thereof.
- 20 24. The composition of claims 14, 16 or 19, wherein the transition metal silicate is effective as a detoxificant of toxic gases and / or toxic chemicals in gaseous forms such as carbon monoxide, sulphur dioxide, an oxide of nitrogen, a hydrocarbon, tobacco tar, nicotine or conversion of toxic gases to non-toxic gases or combinations thereof.
- 25 25. A process for preparing an immobilized transition metal silicate comprising a transition metal silicate in a substance, the process comprising the steps of:
  - (a) adding a solution comprising a transition metal to the substance to form a first product;
  - (b) adding a solution comprising a silicate to the first product to form a second product; and
  - 30 (c) removing a non-immobilized material from the second product to form the immobilized transition metal silicate.
26. The process of claim 25, further comprising drying the immobilized transition metal silicate.

27. The process of claim 25, wherein the substance is selected from a group consisting of an agropolymer, activated alumina, aluminium oxide, cellulose, vinyl ester resin, a bisphenol resin, an isophthalic food grade resin, quartz sand, silica gel and combinations thereof.
- 5 28. A process of incorporating a transition metal silicate in a resin, comprising:
- (a) preparing the transition metal silicate by reacting a silicate with a transition metal salt; and
  - (b) adding the transition metal silicate to the resin to form a transition metal containing resin.
- 10 29. The process of claim 28, further comprising polymerizing the resin.
30. The process of claim 28, wherein said polymerizing is done without any metallic catalyst and / or allowing the reaction mixture at room temperature till completion of polymerization.
31. The process of claim 28, further comprising removing a non-incorporated material.
- 15 32. The process of claim 28, further comprising mixing the transition metal containing resin to a solid material.
33. The process of claim 28, wherein the solid material is alumina, aluminum oxide, an agropolymer, cellulose, quartz sand, silica gel or combinations thereof.
34. A process of physical immobilization and / or coating of a transition metal silicate containing resin on a substance, comprising:
- 20
- (a) adding transition metal silicate to a resin selected from a group consisting of a vinyl ester resin, a bisphenol resin, a isophthalic food grade resin and combinations thereof;
  - (b) coating transition metal silicate containing resin on solid matrix such as quartz sand;
  - (c) drying or polymerizing or immobilizing the transition metal silicate containing resin by heating at 50 to 90 degrees centigrade and / or by keeping the reaction mixture at room temperature till completion of polymerization, and
  - (d) removing the non-immobilized material.
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- 30 35. A method of decontaminating a material using the transition metal silicate of claim 1, comprising:

- (a) exposing the material to an effective amount of the transition metal silicate;  
and
  - (b) decontaminating the material.
36. The method of claim 35, wherein the material is a metal, a chemical, a pesticide or  
5 microbe or combinations thereof.
37. A method of disinfecting a material using the transition metal silicate of claim 1,  
comprising:
- (a) exposing the material to an effective amount of the transition metal silicate  
and
  - 10 (b) disinfecting the material.
38. The method of claim 37, wherein the material is a bacteria, a fungus, a virus, a  
microbe or a pathogen or combinations thereof.
39. A method of detoxifying a material using the transition metal silicate of claim 1,  
comprising:
- 15 (a) exposing the material to an effective amount of the transition metal silicate  
and
  - (b) detoxifying the material.
40. The method of claim 39, wherein the material is carbon monoxide, sulphur dioxide,  
20 an oxide of nitrogen, a hydrocarbon, tobacco tar, nicotine or toxic gases or  
combinations thereof.
41. A method of decontaminating a material using the composition of claims 14, 16 or  
19, comprising:
- (a) exposing the material to an effective amount of the composition and
  - 25 (b) decontaminating the material.
42. The method of claim 41, wherein the material is a metal, a chemical, a pesticide or  
combination thereof.
43. A method of disinfecting a material using the composition of claims 14, 16 or 19,  
comprising:
- 30 (a) exposing the material to an effective amount of the composition and
  - (b) disinfecting the material.
44. The method of claim 43, wherein the material is a bacteria, a fungus, a protozoan, a  
virus, a microbe or a pathogen or combinations thereof.

45. A method of detoxifying a material using the composition of claims 14, 16 or 19, comprising:
- (a) exposing the material to an effective amount of the composition and
  - (b) detoxifying the material chemical conversion of toxic gases and / or toxic chemical containing gases into non-toxic form.
46. The method of claim 45, wherein the material is carbon monoxide, sulphur dioxide, an oxide of nitrogen, a hydrocarbon, tobacco tar, nicotine or toxic gases or combinations thereof.
47. The method as claimed in claims 35, 36 41 or 42 wherein the decontamination includes the sequestration of the chemicals such as phenols, trihalomethanes, polychlorinated biphenyls, volatile organic compounds, and semi volatile organic compounds like pollutant chemicals.
48. The method as claimed in claims 35, 36 41 or 42 wherein the decontamination includes removal and / or absorption and / or sequestration of proteins or peptides like charged molecules.
49. A functional transition metal silicate as claimed in claims 1, 2, 3, 4 or 5 wherein inclusion of desired functionality in a selected functional transitional metal silicate is attainable by optimization of synthetic conditions therefore enabling to obtain functionally effective transition metal silicates to use in various applications such as catalysts and hybridizing or doping with zeolites.
50. A composition comprising a transition metal silicate immobilized on a substance as claimed in claims 14, 16 or 19 wherein inclusion of desired functionality in a selected functional transitional metal silicate is attainable by optimization of synthetic conditions therefore enabling to obtain functionally effective transition metal silicates to use in various applications such as catalysts and hybridizing or doping with zeolites.
51. A functional transition metal silicate as claimed in claim 1, wherein protection by transition metal silicates includes application of transition metal silicate containing substances in infection and pollution prone areas in the form of cleaning solutions and / or in the form of detergents and / or disinfectants and / or shampoos and / or seed coat treatments etc., to protect from microbial and / or chemical contaminations.

52. A composition comprising a transition metal silicate immobilized on a substance as claimed in claims 14, 16 or 19, wherein protection by transition metal silicates includes application of transition metal silicate containing substances in infection and pollution prone areas in the form of cleaning solutions and / or in the form of  
5 detergents and / or disinfectants and / or shampoos and / or seed coat treatments etc., to protect from microbial and / or chemical contaminations.
53. A composition comprising a transition metal silicate immobilized on a substance as claimed in claim 19, wherein immobilized functional metal silicates obtained by coating functional transition metal silicate containing resin on quartz sand have  
10 utility of decontamination and disinfection in high temperature zones such as boilers etc. due to thermostability of the said material.